

Balanced chemical equations

Learning objectives

- 1 Explain why chemical equations need to be balanced.
- 2 Construct and interpret balanced symbol equations.
- 3 Show how the symbolic representation of a reaction links to observations made in the laboratory.
- 4 Integrate equations into written discussions and explanations.

Introduction

When we write about chemistry, we often use a type of 'shorthand' in the form of formulas and equations. While word equations can be used, symbol equations can often give us more useful information about the reaction, particularly when the name of a substance doesn't make it obvious which elements it is made of (for example, methane is CH_4).

It is essential to balance symbol equations to make sure they obey the law of conservation of mass. When we have an accurately constructed equation, it can help us make predictions about what we should observe and how much of each reactant we need for reactions to be efficient.

Instructions

1. Stick the structure strip in the margin of your exercise book/paper.
2. Reflect on what you already know about balanced chemical equations and where you have seen the key terms before. Follow the prompts and use your knowledge to write a summary of balanced chemical equations. If you'd like more support, what other sources can you use to find the information, e.g. a textbook, online?
3. Answer the extended answer question to apply your knowledge of balanced chemical equations to a new context.

Key words

Use these key words and phrases in your responses:

• ratio • mass • atom • molecule • aqueous • limiting • excess • incomplete combustion • complete combustion • reactant • product

Structure strip Balanced chemical equations	Structure strip Balanced chemical equations	Structure strip Balanced chemical equations	Structure strip Balanced chemical equations	Structure strip Balanced chemical equations
State the law of conservation of mass.	State the law of conservation of mass.	State the law of conservation of mass.	State the law of conservation of mass.	State the law of conservation of mass.
$\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ Explain how you know the above equation is unbalanced, and how to balance it.	$\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ Explain how you know the above equation is unbalanced, and how to balance it.	$\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ Explain how you know the above equation is unbalanced, and how to balance it.	$\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ Explain how you know the above equation is unbalanced, and how to balance it.	$\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ Explain how you know the above equation is unbalanced, and how to balance it.
This equation is balanced: $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ Explain the meaning of the 2 in front of H_2O and the 2 within H_2O .	This equation is balanced: $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ Explain the meaning of the 2 in front of H_2O and the 2 within H_2O .	This equation is balanced: $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ Explain the meaning of the 2 in front of H_2O and the 2 within H_2O .	This equation is balanced: $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ Explain the meaning of the 2 in front of H_2O and the 2 within H_2O .	This equation is balanced: $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ Explain the meaning of the 2 in front of H_2O and the 2 within H_2O .
Write out the four state symbols and give their meanings. Add state symbols to the equation above.	Write out the four state symbols and give their meanings. Add state symbols to the equation above.	Write out the four state symbols and give their meanings. Add state symbols to the equation above.	Write out the four state symbols and give their meanings. Add state symbols to the equation above.	Write out the four state symbols and give their meanings. Add state symbols to the equation above.
Define the term 'limiting reactant'.	Define the term 'limiting reactant'.	Define the term 'limiting reactant'.	Define the term 'limiting reactant'.	Define the term 'limiting reactant'.
In the reaction between sodium and water, sodium is usually the limiting reactant. Explain what you observe that confirms this.	In the reaction between sodium and water, sodium is usually the limiting reactant. Explain what you observe that confirms this.	In the reaction between sodium and water, sodium is usually the limiting reactant. Explain what you observe that confirms this.	In the reaction between sodium and water, sodium is usually the limiting reactant. Explain what you observe that confirms this.	In the reaction between sodium and water, sodium is usually the limiting reactant. Explain what you observe that confirms this.
Define the term 'excess reactant'.	Define the term 'excess reactant'.	Define the term 'excess reactant'.	Define the term 'excess reactant'.	Define the term 'excess reactant'.
When methane burns it is best if oxygen is in excess, so we have complete combustion (see equation above). Explain the differences if oxygen is the limiting reactant.	When methane burns it is best if oxygen is in excess, so we have complete combustion (see equation above). Explain the differences if oxygen is the limiting reactant.	When methane burns it is best if oxygen is in excess, so we have complete combustion (see equation above). Explain the differences if oxygen is the limiting reactant.	When methane burns it is best if oxygen is in excess, so we have complete combustion (see equation above). Explain the differences if oxygen is the limiting reactant.	When methane burns it is best if oxygen is in excess, so we have complete combustion (see equation above). Explain the differences if oxygen is the limiting reactant.

Extended answer question

In the reaction between hydrochloric acid (HCl) and magnesium metal (Mg), the products are soluble magnesium chloride (MgCl_2) and hydrogen gas (H_2).

Construct a balanced symbol equation for the reaction, including state symbols.

Compare the observations you would make during the reaction when the magnesium is in excess and when it is the limiting reactant.

Refer to your equation in your answer.